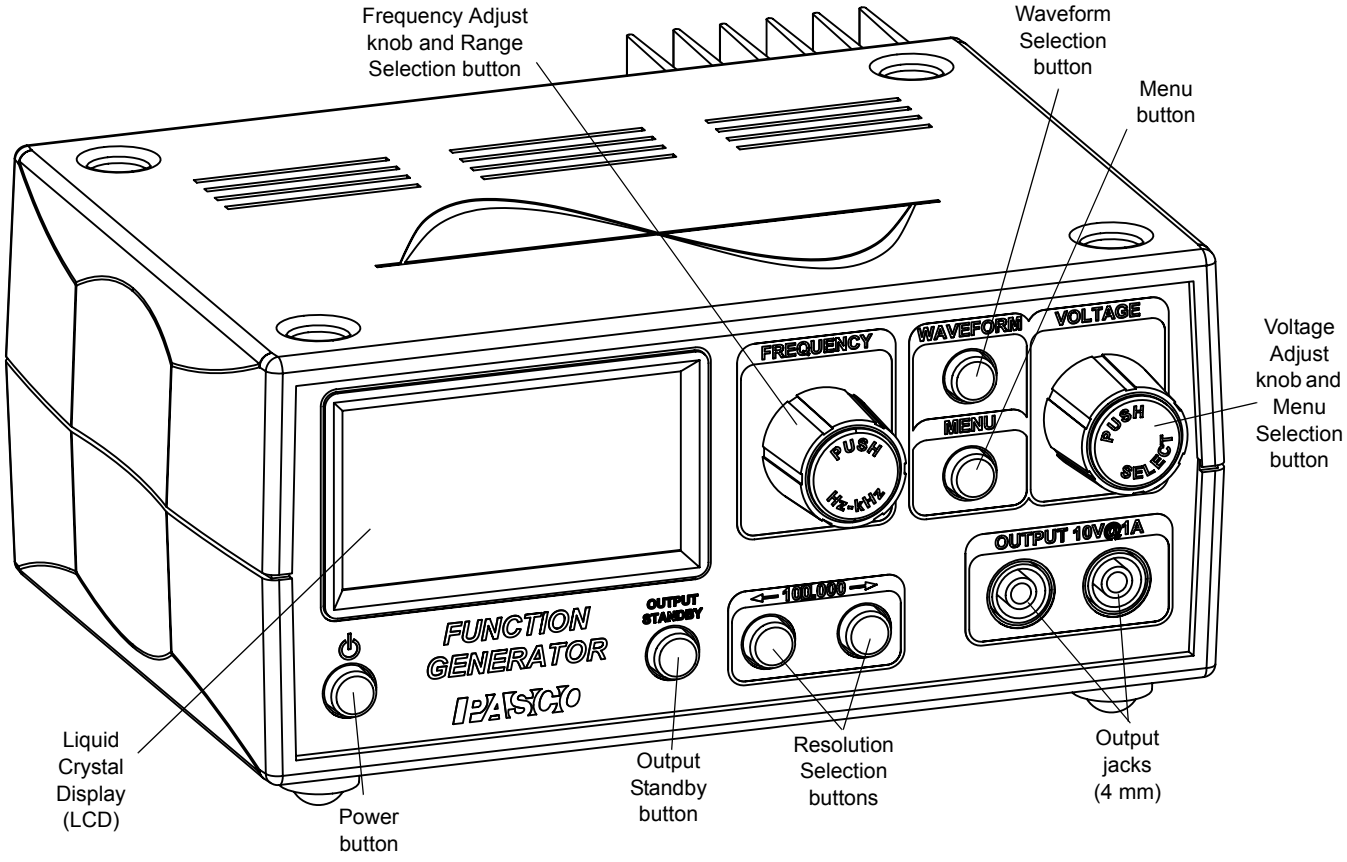
Function Generator

PI-8127

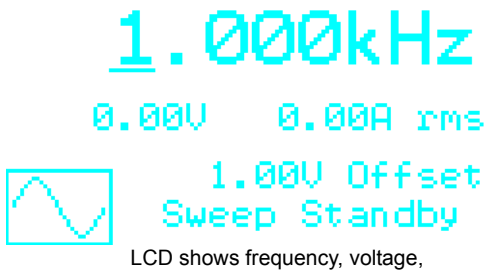


Included Equipment	**Part Number**
Function Generator	
AC to 15 V DC, 1.6 A power adapter (not shown)	540-057
Examples of Compatible PASCO Equipment	(See the PASCO Catalog for details)
Mechanical Wave Driver	SF-9324
Open Speaker	WA-9900
AC/DC Electronics Laboratory	EM-8656
RLC Circuit Board	CI-6512

Introduction

The PASCO Function Generator outputs waveforms that include DC (direct current) as well as sine, square, triangle, positive ramp, and negative ramp with a frequency range of 0.001 Hz (hertz) to 100 kHz (kilohertz). The sine waveworm retains its form up to a frequency of 150 kHz, but the other waveforms will show some distortion above 100 kHz. Its 10 watt power output (up to 10 volts and up to 1 amp) makes it useful for driving speakers, string vibrators, and circuits.

Features



LCD shows frequency, voltage, current, and waveform as well as other information such as the voltage offset and sweep condition.

Liquid Crystal Display (LCD): The liquid crystal display (LCD) shows frequency, voltage, current, and waveform. The lower right section of the LCD also shows other information such as the voltage offset of the output, if any, whether a frequency sweep is on, and whether the output is on standby.

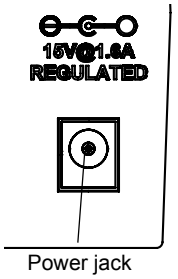
Frequency/Range Selection: There are two frequency ranges: 0.001 Hz to 999.999 Hz, and 0.001 kHz to 100.000 kHz (150 kHz for the sine waveform). When the Function Generator is first turned on, the default frequency is 1.000 kHz. Press the Frequency Adjust knob as if it were a button to switch between ranges.

Output Standby: Pushing the Output Standby button disables the output without changing settings. This allows you to change settings with the output off. Press the button again to enable the output.

Output Current/Voltage Maximum: The maximum current or maximum voltage can be set using a menu. This is useful when the voltage applied to a circuit needs to be limited. The LCD displays the output voltage and current.

Offset Voltage: Any waveform can be offset up or down with a DC voltage ranging from -10 V to +10 V, provided the peak voltage does not exceed 10 V.

Frequency Sweep: Sweep between two frequencies at a selectable rate.

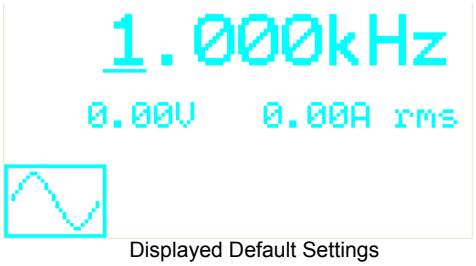


Power jack

Operation

Power: Connect the plug from the AC-to-15 V DC adapter to the power jack on the lower right corner of the back panel of the Function Generator. Connect the power cord for the adapter to an appropriate electrical outlet.

On/Off: To turn the Function Generator *on*, press the Power button on the lower left corner of the front panel. Press the Power button again to turn the Function Generator *off*.



Displayed Default Settings

Default Settings: The displayed default settings when the Function Generator is first turned on are 1.000 kHz (frequency), 0.00 V (output voltage), 0.00 A (output current), and sine wave (waveform). The waveform symbol is shown at the lower left corner of the LCD.

Settings that are *not* shown by default are the voltage offset (0.00 V) and the voltage limit (maximum voltage), which is 10.0 V, the short circuit current limit (maximum current), which is 1.50 A, the backlight setting (“High”), and the sweep setting (“Off”). See the **Menus** section for more information.

Output: Connect a device such as a speaker, wave driver, or electrical circuit to the output jacks at the lower right corner of the front panel.

Frequency Adjust

The Frequency Adjust knob serves two purposes. Turn the knob to change the frequency. Press the end of the knob as if it were a button to toggle between the two frequency ranges.

Range Selection: The default range is 0.001 kHz to 100.000 kHz or 150.000 kHz for the sine waveform (other waveforms are distorted above 100 kHz). The other range is 0.001 Hz to 999.999 Hz. Press the end of the Frequency Adjust knob as if it were a button to switch between ranges. The default frequency for the lower range is 1.000 Hz.

Frequency Adjust: The default frequency for the default range is 1.000 kHz. Notice that the "1" is underlined in the display. This indicates that this is the digit that will change first when you turn the knob. For example, turn the knob one "click" to the right (clockwise), and the frequency increases to 2.000 kHz. Each "click" to the right (clockwise) or left (counterclockwise) will increment or decrement the *digit that is underlined* in the display. When you reach 9.000 kHz, the next "click" to the right will change the frequency to 10.000 kHz. Notice that the underline stays below the "ones" place. Turning the frequency knob one more "click" to the right changes the frequency to 11.000 kHz.

As a second example, if the frequency is 1.000 kHz, turning the Frequency Adjust knob one "click" to the left (counterclockwise) does not decrease the frequency to 0.000 kHz. Instead, the frequency stays at 1.000 kHz (it is not possible to have zero frequency). To lower the frequency, press the right-hand Resolution Selection button to move the underline to the right (1.000 kHz) and then turn the Frequency Adjust knob counterclockwise one "click" to decrease the frequency to 0.900 kHz.

Resolution Selection: Use the Resolution Selection buttons beneath the Frequency Adjust knob to change the active (underlined) digit in the display. Pushing the left button moves the underline to the left and pushing the right button moves the underline to the right.

Use both the Frequency Adjust knob and the Resolution Selection buttons to set the frequency. Remember that you can push the OUTPUT STANDBY button to disable the output while you adjust the frequency, and then push the button again to enable the output when you have the frequency set the way you want.

Clear Feature: While adjusting the frequency, you can clear (zero) all the digits to the right of the underline cursor by pressing the Voltage Adjust knob as if it were a button.

Voltage Adjust

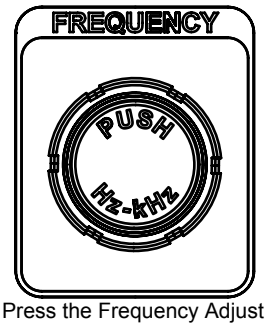
The Voltage Adjust knob serves three purposes.

- Turn the knob to change the output voltage.
- When the LCD shows the waveform list or the menu, turn the Voltage Adjust knob to move the pointer up or down in the list or in the menu.
- Press the knob as if it were a button to select a choice from the waveform list or from the menu.

NOTE:

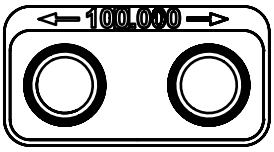
To set up the frequency, voltage, and other parameters without outputting a signal, press the OUTPUT STANDBY button.

Make the adjustments, and press the OUTPUT STANDBY button again to begin the signal.

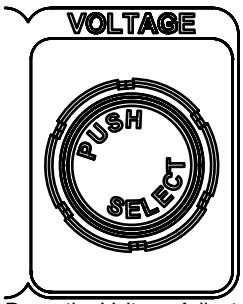


Press the Frequency Adjust knob to change the range.

NOTE: You can conveniently go to the lowest frequency without overshooting by rapidly turning the Frequency Adjust knob.



Resolution Selection buttons



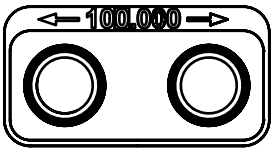
Press the Voltage Adjust knob to select a waveform or menu item

Voltage Adjust: To move the underline from the Frequency part of the LCD to the Voltage part of the LCD, turn the Voltage Adjust knob one "click" to the left or right. Notice that the underline is below the "ones" place in the display (0.00 V). Turn the knob one "click" to the right (clockwise) to increase the voltage output.

Voltage Adjust display

Each "click" to the right (clockwise) or left (counterclockwise) will increment or decrement the *digit that is underlined* in the display. When you reach 9.00 V the next "click" to the right will change the voltage to 10.00 V. Notice that the underline stays below the "ones" place.

Resolution Selection: Use the Resolution Selection buttons below the Frequency Adjust knob to change the active (underlined) digit in the voltage display. Pushing the left button moves the underline to the left and pushing the right button moves the underline to the right.



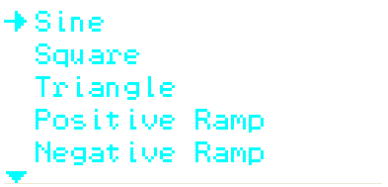
Resolution Selection buttons

Use both the Voltage Adjust knob and the Resolution Selection buttons to set the voltage. Remember that you can push the OUTPUT STANDBY button to disable the output while you adjust the voltage, and then push the button again to enable the output when you have the voltage set the way you want.

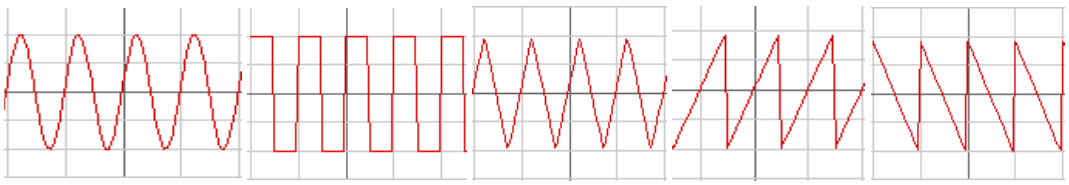
To move the underline back to the Frequency part of the LCD, turn the Frequency Adjust knob one "click" to the left or right.

Waveforms

Press the WAVEFORM button to open the first waveform menu. The menu shows five choices (Sine, Square, Triangle, Positive Ramp, and Negative Ramp) with the pointer at Sine. Turn the Voltage Adjust knob one "click" to the left (counterclockwise) to move the pointer from Sine to Square. Press the Voltage Adjust knob as if it were a button to select the choice. The LCD will show the Square wave icon in the lower left corner.



First WAVEFORM menu


Sine, Square, Triangle, Positive Ramp, and Negative Ramp waveforms. Frequency: 1.000 kHz. Voltage: 2.00 V. Vertical scale: 1 V/div. Horizontal scale: 1 ms/div.

Press the WAVEFORM button again to return to the first waveform menu. Notice the down pointing arrow at the lower left corner. This indicates that there are more choices on the menu. Turn the Voltage Adjust knob counterclockwise to move the pointer to Negative Ramp. Turn the knob one more "click" counterclockwise to show the next choice in the menu, DC (or direct current). Notice that the menu now has an "up" pointing arrow at the upper left corner as well as the down pointing arrow in the lower left corner.

Next WAVEFORM menu

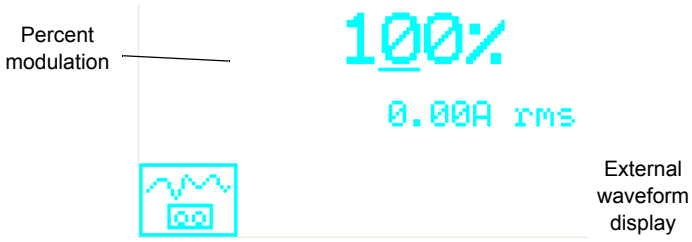
DC: Press the Voltage Adjust knob to select the DC choice. Notice that the LCD shows only voltage and current. Turn the Voltage Adjust knob to increase or decrease the voltage (±10 V maximum).

DC voltage adjust screen

Last WAVEFORM menu

Continue to turn the Voltage Adjust knob counterclockwise to reveal the next five waveform choices: External, Mod Sine, Mod Triangle, Mod Pos Ramp, and Mod Neg Ramp. ("Mod" is an abbreviation for "modulated".)

External Input: The External waveform choice corresponds to the use of an external input to the Function Generator. The generator has positive and negative input jacks on the rear panel. Maximum input voltage is ±10 V. The Function Generator amplifies the power of the input signal up to a maximum of 10 watts (up to 1 amp at up to 10 volts), expressed as a percentage of maximum. Turn the Voltage Adjust knob to decrease or increase the power amplification.



External waveform display

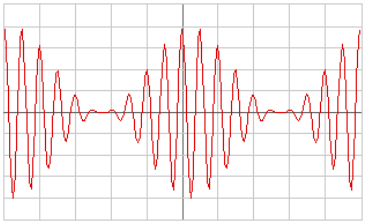
Modulated Waveforms: The modulated (Mod) waveform choices also correspond to the use of an external input to the Function Generator through the input jacks on the rear panel. When a modulated (Mod) waveform is selected, the signal produced by the Function Generator will be *multiplied* by the signal from the external input.

Mod Sine waveform display

Change the frequency of the Function Generator's signal with the Frequency Adjust knob. Adjust the percent modulation with the Voltage Adjust knob. The formula for the percent modulation is based on the amplitudes of the peak (P) and the trough (T) of the modulated signal.

$$\text{percent modulation} = \frac{P - T}{P + T} \times 100$$

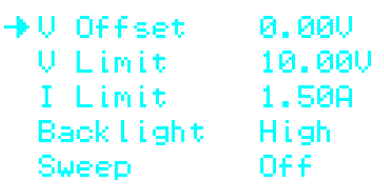
When the percent modulation is 100%, the trough amplitude is zero.



Mod Sine waveform. Input signal is 1 kHz at 2.00 V. Mod Sine signal is 0.100 kHz at 100%.

Menus

Press the MENU button to show the list of choices: V Offset (voltage offset), V Limit (voltage limit), I Limit (short circuit current limit), Backlight, and Sweep. The pointer is at V Offset. Turn the Voltage Adjust knob to move the pointer up or down among the choices. Press the Voltage Adjust knob as if it were a button to select a choice.



MENU choices

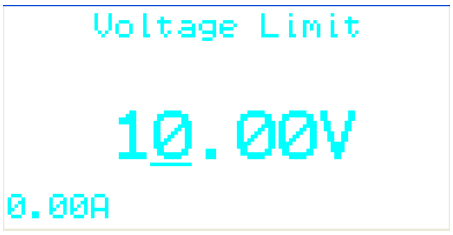
V Offset (voltage offset): The default voltage offset in the Voltage Offset display is 0.00 V. Use the Voltage Adjust knob and the Resolution Buttons to increase or decrease the DC voltage. Any waveform can be offset up or down with a DC voltage ranging from -10 V to +10 V, provided the peak voltage does not exceed 10 V.

Press the MENU button or the Voltage Adjust knob to return to the MENU choices.

Press the MENU button again to return to the screen before the MENU button was pressed the first time.

Voltage Offset display

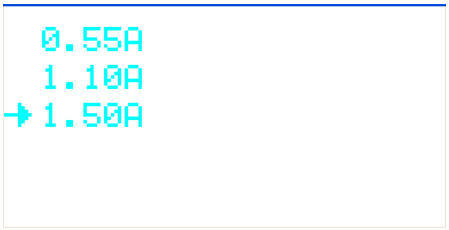
V Limit (voltage limit): The default maximum voltage in the Voltage Limit display is 10.00 V. Use the Voltage Adjust knob and the Resolution Selection buttons to change the maximum voltage from 10.00 V to another voltage. The minimum voltage is 0.00 V.



Voltage Limit display

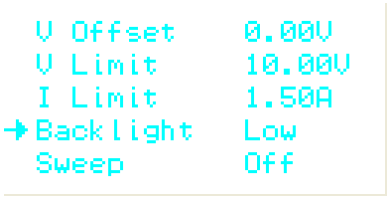
I Limit (current limit): The default maximum current in the Current Limit display is 1.50 A. Turn the Voltage Adjust knob to change the maximum current from 1.50 A to 1.10 A or to 0.55 A. Press the Voltage Adjust knob as if it were a button to select the current limit. Setting the maximum current is useful when there needs to be a limit to the current applied to a circuit. This is a safety feature to protect against short circuit overload.

NOTE: As the current approaches the limit, “Overcurrent” will be displayed at the bottom of the LCD. The “Overcurrent” warning will be displayed at approximately 1.2 A for the 1.50 A limit, 1.0 A for the 1.10 A limit, and 0.5 A for the 0.55 A limit.



Current Limit display

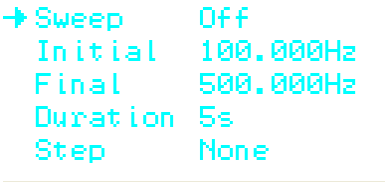
Backlight: The default backlight setting is “High”. Use the Voltage Adjust knob to select the menu choice. Press the Voltage Adjust knob as if it were a button to toggle (switch) to the other choice: “Low”. The Low setting is useful when the Function Generator is in a darkened environment.



Backlight Low

Sweep: Turn the Voltage Adjust knob so the pointer is next to Sweep and then press the knob as if it were a button to select the choice. The default setting is “Off”.

The Sweep menu options offer several ways to tailor the output signal for specific needs. The Sweep function is set up so that the output signal begins at a specific frequency (Initial) and ends at another specific frequency (Final). The ‘sweep’ between frequencies can be set to last for a certain time (Duration), and the step frequency (Step) can also be set for a specific amount..

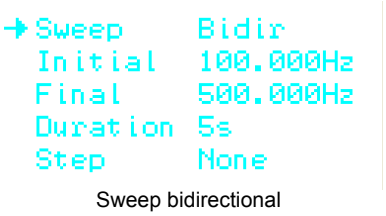


Sweep options

The Sweep function can be set to one of the following:

- Off: The default setting.

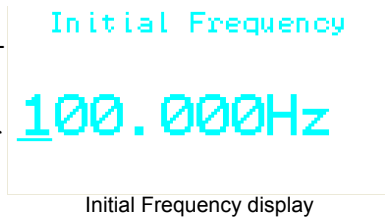
- Single: The frequency ‘sweeps’ from the initial frequency to the final frequency one time.
- Repeat: The frequency ‘sweeps’ between the initial and final frequencies repeatedly.
- Bidir (bidirectional): The frequency sweeps from the initial frequency to the final frequency and then back to the initial frequency repeatedly.



Sweep bidirectional

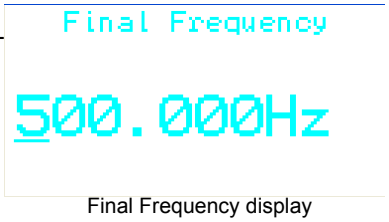
Press the Voltage Adjust knob as if it were a button to ‘step through’ the Sweep choices. Press the MENU button to return to the previous display, or use the Voltage Adjust knob to move the pointer to another choice.

Initial: The default initial frequency is 100.000 Hz. Turn the Voltage Adjust knob so the pointer is next to ‘Initial’ and then press the knob to select the choice. Use the Frequency Adjust knob and the Resolution Selection buttons to set the initial frequency. Remember that you can press the Frequency Adjust knob as if it were a button to switch frequency ranges. Press the Voltage Adjust knob again to return to the menu of Sweep options. .



Initial Frequency display

Final: The default final frequency is 500.000 Hz. As with the initial frequency, use the Voltage Adjust knob to select the choice, and the Frequency Adjust knob and Resolution Selection buttons to set the final frequency. Press the Voltage Adjust knob as if it were a button to return to the menu of Sweep options. .

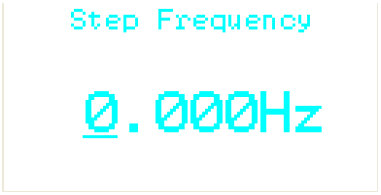


Final Frequency display

Duration: The default duration for the sweep is 5 seconds. As with the initial frequency, use the Voltage Adjust knob to select the choice. Use the Voltage Adjust knob and the Resolution Selection buttons to change the duration time. The minimum is 1 second and the maximum is 9999 seconds (2 h, 46 min, 39 s). Press the Voltage Adjust knob as if it were a button to return to the menu of Sweep options..

Duration display

Step: The default step frequency is ‘None’. This means that the default frequency sweep will be *continuous* from the initial to the final frequency. As with the initial frequency, use the Voltage Adjust knob to select ‘Step’ and press the knob as if it were a button. Use the Frequency Adjust knob and the Resolution Selection buttons to change the step frequency. The range for the step frequency is from 0.001 Hz to 100.000 kHz (or 150 kHz for the Sine waveform). In general it is best to pick a step frequency that is *less* than the difference between the initial and final frequencies.



Step Frequency display

In general it is best to pick a step frequency that is *less* then the difference between the initial and final frequencies.

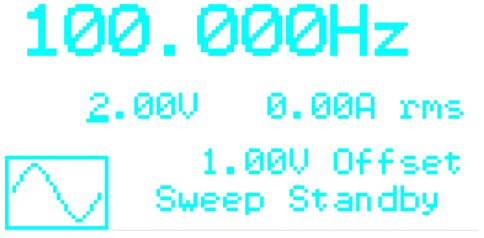
Remember, you can press the Frequency Select knob as if it were a button to switch the frequency range.

Press the Voltage Adjust knob as a button to return to the menu of Sweep options.

Press the MENU button to exit the menu of Sweep options, and press the MENU button again to exit the main menu.

Standby: When a sweep function other than ‘Off’ is selected, the generator automatically goes into the ‘Standby’ condition. That is, the generator will not output its signal until the OUTPUT STANDBY button is pressed. Press the OUTPUT STANDBY button again to disable the output..

The Example display shows Frequency at 100.000 Hz, Voltage at 2.00 V, output current at 0.00 A, V Offset (voltage offset) at 1.00 V, Sine waveform, Sweep function is ‘On’, and the generator’s output is on ‘Standby’.



Example display

Other

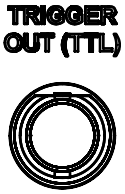
Current

Several displays show the root mean square ('rms') output current (0.00A rms). The Function Generator calculates the true root mean square of the output current, not just the peak current divided by the square root of two. The output current depends on the output voltage and the resistance of the device or circuit to which the generator is connected. For example, if you set the generator to output 5.00 V DC and connect the output to a 10 ohm resistor, the output current display will show approximately 0.50A rms. If you change to a Sine Wave, the current will read 0.707 x 0.5A = 0.35A rms.

The name "root mean square" comes from the fact that it is the square root of the mean of the squares of the values.

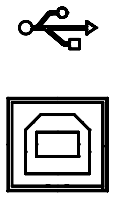
Trigger Output

On the rear panel is a BNC connector labeled TRIGGER OUT (TTL). If you want to trigger an oscilloscope synchronously with the generator output, just connect the TRIGGER OUT (TTL) connector to the external trigger of the oscilloscope (cable not included).



USB Port for Firmware Update

Next to the TRIGGER OUT (TTL) connector on the rear panel is a USB port. The USB port allows a USB cable (not included) to be connected from a computer to the Function Generator so that its firmware can be updated. Go to www.pasco.com/downloads for instructions.



USB Port

Some Suggested Uses

In addition to the usual uses of a function generator such as providing sine wave signals for electronics laboratories, the PI-8127 Function Generator is particular suited for experiment in waves and acoustics.

Drive a speaker - or several speakers - with the Function Generator. Accurately set the frequency to any level in the acoustic range or beyond. This makes it particularly convenient for experiments such as measuring the speed of sound, observing the interference and diffraction of sound waves, and investigating acoustic resonance in a cavity.

Use the Function Generator with the PASCO Resonance Tube (see www.pasco.com) to investigate resonant modes and the speed of sound in a closed or open tube.

Use the Function Generator with the PASCO Sonometer and Driver/Detector Coils to measure resonant frequencies and harmonics and the location of nodes and antinodes on a wire.

The built-in amplifier makes it an ideal device for driving mechanical wave experiments. Use the generator with a PASCO Mechanical Wave Driver to examine the resonance modes in a vibrating wave cord. Experiment with the motion of waves in two dimensions by using sand on the thin metal plates of the PASCO Chladni Plate Kit.

Use the generator with the PASCO Coupled Harmonic Oscillators to study coupled harmonic motion of two or more gliders on an air track.

Connect the Function Generator to a resistor-capacitor (RC) circuit such as the PASCO RLC Circuit Board and measure the voltage across the resistor as the generator drives the circuit with a square wave.

Voltage across the resistor in a resistor-capacitor circuit driven by a square wave.

Specifications

Input Power	15 V at 1.6 A
Voltage Output	±10 V at up to 1 A
Frequency Range	DC to 100 kHz with two ranges: 0.001 Hz to 999.999 Hz and 0.001 kHz to 100.000 kHz (150 kHz for Sine Wave)
Frequency Resolution	0.001 Hz for the lower range and 1 Hz for the upper range
Offset Voltage	±10 V
External Voltage Input	±10 V Maximum
Trigger Output	TTL compatible (0 to 5 V)
Waveforms	Sine, Square, Triangle, Positive Ramp, Negative Ramp, DC, Mod Sine, Mod Square, Mod Pos Ramp, Mod Neg Ramp
Default Displays	Frequency, Voltage, Current, Waveform
Display	LCD Graphics Monochrome, 128 by 64 pixels, 2-level Backlight

Technical Support

For assistance with any PASCO product, contact PASCO at:

Address: PASCO scientific
10101 Foothills Blvd.
Roseville, CA 95747-7100

Phone: 916-786-3800 (worldwide)
800-772-8700 (U.S.)

Fax: (916) 786-3292

Web: www.pasco.com

Email: support@pasco.com

Limited Warranty
For a description of the product warranty, see the PASCO catalog.

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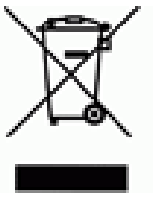

The European Union WEEE (Waste Electrical and Electronic Equipment) symbol (to the right) and on the product or its packaging indicates that this product **must not** be disposed of in a standard waste container.